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Alameda County
Environmental Health

January 31, 2008
Project No. SCS217

Ms. Deborah Castles
McGrath Properties
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Oakland, CA 94607
(510) 273-2000

and

Mr. Barney M. Chan
Senior Hazardous Materials Specialist
Alameda County Environmental Health
1131 Harbor Bay Parkway
Alameda, CA 94502-6577
(510) 567-6700

Reference: **Former Kozel Property**
1001 – 42nd Street
Emeryville, California

Subject: **Work Plan for:**
- **Implementation of Phase A of Corrective Action Plan (CAP)**
- **Installation of Pilot-Scale Remediation & Recovery System**

Dear Ms. Castles and Mr. Chan:

SCHUTZE & Associates, Inc. (Consultant) is pleased to submit this Work Plan to ACEH[1] (Agency) and McGrath Properties, Inc. (Client). The purpose of the proposed work is to implement the first Phase (Phase A/Pilot Test) of the CAP[2] prepared by Environmental Resource Management (ERM) for the property located at 1001 42nd Street in Oakland and Emeryville, California (subject site).

The subject site is bounded by 42nd Street to the north, 41st Street to the south, Linden Street to the east, and various residential properties to the west. The subject site is located approximately one mile from the San Francisco Bay. The subject site is developed with three commercial structures. The buildings are currently vacant. Previous activities on the subject site include paint and varnishing manufacturing, print production and furniture refinishing.

[1] Alameda County Environmental Health
[2] Corrective Action Plan

A. PROPERTY LOCATIONS AND HISTORICAL ACTIVITIES

The subject site is located in an area, which has been historically the location of various light industrial and paint manufacturing facilities.

The subject site is located on the northwest corner of the intersection of 41st and Linden Streets. The property is developed with three brick buildings and a central concrete-paved yard with loading areas. Boysen Paint Company owned and operated the facility from the mid-1930s to the early 1980s. Boysen Paint Company was subsequently merged into the Ameritone Paint Corporation, a wholly owned subsidiary of the Grow Group. The property's history of storage tanks involved eight ASTs[3] and three USTs[4]. The capacities of the USTs were 300, 8,000 and 10,000 gallons and the tanks were used to store mineral spirits. The ASTs and the 10,000-gallon UST were removed. The 8,000 and 300-gallon USTs were closed in place. In addition, two steel-lined sumps were closed in 1995 by filling them with concrete.

Edward Kozel purchased the property in 1981 and leased it to the ONE Company. The ONE Company operated at the site until approximately 2005. The Rockridge Furniture Refinishing Property occupied a portion of the property in the late 1980s. The buildings on the subject site are currently vacant.

B. ENVIRONMENTAL CONDITIONS AT THE SUBJECT SITE

In 1987, the 10,000-gallon UST used for mineral spirits, was removed from beneath a truck-loading dock on 41st Street. The 8,000-gallon UST beneath the sidewalk along 41st Street was previously abandoned in place and filled with concrete slurry. A third UST with a 300-gallon capacity was discovered in 1994 below the building on the east side of the property adjacent to Linden Street. The two sumps were closed in place in 1993.

Aqua Science Engineers (ASE) performed soil and groundwater investigations in 2005. Based on the ASE report, no significant soil contamination was discovered. A plume of free-phase total petroleum hydrocarbons specified as mineral spirits (TPH-ms) in groundwater was associated with the former USTs, measuring in east-west direction approximately 300 ft and in north-south direction approximately 100 ft. The plume was positioned beneath the southern portion of the subject site and properties adjacent to the west, and the northern sidewalk and partial roadway of 41st Street. Significant concentrations of VOCs[5] were not detected. The six monitoring wells installed for this investigation have been monitored on a quarterly basis. Free product was observed in two wells, MW-B1 and MW-BES1, near the former 8,000-gallon UST.

[3] Aboveground storage tank(s)
[4] Underground storage tank(s)
[5] Volatile organic compound(s)

ERM performed a follow-up soil and groundwater investigation in 2006. The scope of services was approved by Mr. Barney Chan of ACEH. TPH-ms in soil was detected at concentrations of up to 620 mg/kg[6]. TPH-ms in groundwater was detected at concentrations of up to 460 μg/L[7].

ERM performed limited indoor air investigations in September 2006. Low concentrations of VOCs were detected, however, the concentrations were below the ESLs[8] of the RWQCB[9], and also below the CHHSLs[10] of the DTSC[11]. TPH-ms was not detected in indoor air samples.

In a letter dated October 12, 2006, Mr. Chan requested the following:

- An evaluation of the risk presented by TPH-ms in groundwater to occupants of the subject site, adjacent and down-gradient sites (completed by Geomatrix, June 29, 2007),
- Further site investigations with special regard to potentially existing deeper migration channels, and
- A CAP for on-site and off-site remediation.

In June 2007, ERM submitted a draft CAP to ACEH. As part of the CAP, ERM proposed the installation of four 4" diameter recovery wells on the subject site where free-phase product was observed and three 4" diameter recovery wells where off-site migration was indicated. The proposed extraction method was vacuum-enhanced skimming. No soil excavation or dissolved phase remediation was recommended by ERM. The success of the remediation was to be monitored by groundwater testing in four additional wells and periodic indoor-air quality monitoring. The on-site portion of the CAP included location and repair or replacement of existing monitoring well MW-B1 and sampling of the existing monitoring wells.

On September 13, 2007, ACEH commented on the draft CAP and requested the following additional submittals:

- A Site Conceptual Model (SCM) depicting the release scenario for the subject site (including additional up-gradient sampling if up-gradient sources are suspected);
- Names, addresses, and parcel numbers for neighboring sites that might have "direct or indirect impacts from the proposed corrective actions," for purposes of Public Notification;

[6] Milligrams per kilogram
[7] Micrograms per liter
[8] Environmental Screening Levels
[9] Regional Water Quality Control Board
[10] California Human Health Screening Levels
[11] State of California Department of Toxic Substances Control

- Further details regarding implementation and design details for the proposed remedial action, including the following:
    - The method for determining the radius of influence for the five proposed recovery wells;
    - The extent of treatment to be performed within the free product area;
    - The procedures for determining the need for additional recovery wells or monitoring wells to improve remediation efficiency and monitor progress, including an evaluation of the feasibility of installing an extraction trench;
    - The approach that will be undertaken to verify remediation completion, including a post-remediation sampling plan;
    - Details of recovery and monitoring well construction, including diagrams; and
    - Establishment of soil and ground water target cleanup levels (ESLs identified as appropriate goals);
- Relevant site documents to the Geotracker database and the County website; and
- A proposal for addressing monitoring well MW-B1, which was paved over in the sidewalk area, describing the procedures that will be followed to uncover and repair or properly decommission it.

In addition, in a 28 September 2007 e-mail correspondence, ACEH indicated their desire for demonstration that the proposed remedial action will be effective (e.g., a pilot test or Interim Remedial Action).

C. PROPOSED SCOPE OF SERVICES

SCHUTZE & Associates, Inc. proposes to perform the following scope of work for the subject site.

C.1 Task 1 - Site Conceptual Model (SCM)

SCHUTZE & Associates Inc. proposes to prepare an SCM, consisting of graphic representations of our interpretation of the release scenario for the subject site and the localized statigraphy beneath the subject site, focused on paleo-channel/coarse-grained intervals. The SCM shall be based on the evaluation of existing reports and boring logs. The SCM shall also include the potential of up-gradient sources impacting the subject site, as well as potential sampling. Based on the results of the SCM, SCHUTZE & Associates Inc. may recommend an additional soil and groundwater investigation, as well as the installation of an additional groundwater monitoring well.

ACEH is currently developing a new way of compiling, communicating and archiving SCMs[12]. SCHUTZE & Associates, Inc. will follow the ACEH guidelines for an electronic

[12] Alameda County Environmental Health, "Electronic Site Conceptual Model (SCM) Example Format," <http://www.acgov.org/aceh/lop/scm.htm>

version of an SCM as closely as possible.

C.2 Task 2 – Public Notification

SCHUTZE & Associates, Inc., in conjunction with McGrath's public relations firm, proposes to prepare a list of names, addresses and parcel numbers for neighboring sites that may have direct or indirect impacts from the proposed work under this proposal.

C.3 Task 3 – Remediation Design Specifications

Based on the results of the pilot test, SCHUTZE & Associates, Inc. proposes to provide the following design specifications, which will be added as an addendum to the CAP:

- The methodology for determining the radius of influence for the recovery wells, which will be calculated by the amount of free product recovered and the measured reduction of free product in nearby monitoring wells;
- The extent of treatment to be performed within the free product area, which will be calculated on the basis of the radius of influence;
- The procedures for determining requirements for additional recovery wells and/or monitoring wells to improve remediation efficiency and monitor progress, which will be based on the results of this Work Plan;
- The methodology for verifying remediation completion, including the post-remediation sampling plan;
- The specifications and diagrams for recovery well and monitoring well construction; and
- Soil, groundwater and air target cleanup levels, which shall be in accordance with the Human Health Risk Assessment prepared by Geomatrix.

C.4 Task 4 – GeoTracker Upload

SCHUTZE & Associates, Inc. and Client propose to review the current content of the GeoTracker database Alameda County LOP[13] records, confirm existing reports and upload relevant reports that are not present in the database, specifically, reports prepared by ERM or ASE between January 2005 and June 2007.

[13] Local Oversight Program

C.5 Task 5 – Repair or Replacement of Monitoring Well MW-B1

SCHUTZE & Associates, Inc. has located a Christie box at the position of the missing groundwater monitoring well MW-B1 and proposes to further explore if the remnants of the well exist at this location. If the well is usable, it shall be repaired and developed. If the well is not usable, it shall be abandoned per local guidelines and regulations and a new well shall be installed and developed.

C.6 Task 6 – Groundwater Sampling

SCHUTZE & Associates, Inc. proposes to perform a sampling event on the existing groundwater monitoring wells, i.e., MW-B2, MW-B3, MW-B4 and BES-1. Sampling events shall also be performed on the new monitoring well proposed under Task 8 as well as the repaired or replaced monitoring well MW-B1. Depth to water from TOCs[14] and free product thickness shall be measured for each well.

Groundwater samples shall be sampled for the following:

- TPH-ms[15] using EPA[16] Method 8015C,
- TPH-g[17] and MBTEX[18] using EPA Method 8015C,
- TPH-d, TPH-mo, TPH-k and TPH-bo[19] using EPA Method 8015C, and
- VOCs[20] using EPA Method 8260B.

C.7 Task 7 – Details of the Pilot-Scale Free Product Skimming System

SCHUTZE & Associates, Inc. has attached details for the installation of piping, connections, wells, pumps, blower (optional) and other components of the pilot-scale system. Bids for the system have been obtained. The depths of the proposed skimming wells will be 14 ft bgs with a screened interval from 5 to 15 ft bgs.

Design specifications for the remediation and recovery system, as well as figures for the recovery wells and monitoring well are attached to this Work Plan under Appendix A.

C.8 Task 8 – Pilot-Scale System Construction and Initialization

SCHUTZE & Associates, Inc. proposes to provide project management for implementation of the on-site remediation and recovery system, recovery trench,

[14] Tops of well-casings
[15] Total Petroleum Hydrocarbon as mineral spirits
[16] U.S. Environmental Protection Agency
[17] Total petroleum hydrocarbons as gasoline
[18] Methyl tert-butyl ether (MTBE), benzene, toluene, ethylbenzene and xylenes
[19] Total petroleum hydrocarbons as diesel (d), motor oil (mo), kerosene (k) and bunker oil (bo)
[20] Volatile organic compounds

recovery wells and the new monitoring well. The scope of this work includes:

- Trenching and piping installation activities,
- Installation of three on-site recovery wells and one on-site recovery trench,
- Installation of one on-site monitoring well,
- Recovery system construction, connection, initialization, modification and refinement,
- System testing, including radius of influence evaluation and blower step test,
- Purchase of remediation equipment, permitting, sample analysis, solid waste and recovered product disposal, and
- Engagement of drilling and construction subcontractors.

C.9 Task 9 – Operation, Maintenance and Reporting

SCHUTZE & Associates, Inc. proposes to provide operation and maintenance activities for on-site implementation of the CAP remediation and recovery system. The scope of this work includes:

- Operation of the pilot-scale remediation and recovery system for an initial three-month period,
- Weekly on-site inspections, product thickness measurements and air emissions monitoring,
- Review of pilot-scale remediation and recovery system efficiency and corresponding analysis, adjustments and modifications,
- Monthly emissions sampling and review to ensure compliance with BAAQMD[21] requirements[22],
- Pilot-scale remediation and recovery system initialization, modification and refinement,
- Recovered product disposal, and
- Preparation of a report documenting the activities and results of the initial three-month operation of the pilot-scale remediation and recovery system.

D. PERJURY STATEMENT

I declare, under penalty of perjury, that the information and/or recommendations contained in this document is true and correct to the best of my knowledge.

Please call Jan Schutze at (510) 625-8175 (office) or (415) 517-8100 (cell phone), if you need further information. We look forward to working with you on this project.

[21] Bay Area Air Quality Management District
[22] SCHUTZE & Associates, Inc. proposes to rent the blower system for the pilot test for a period of 2 weeks and record changes in the recovery rate for that period.

Cordially,

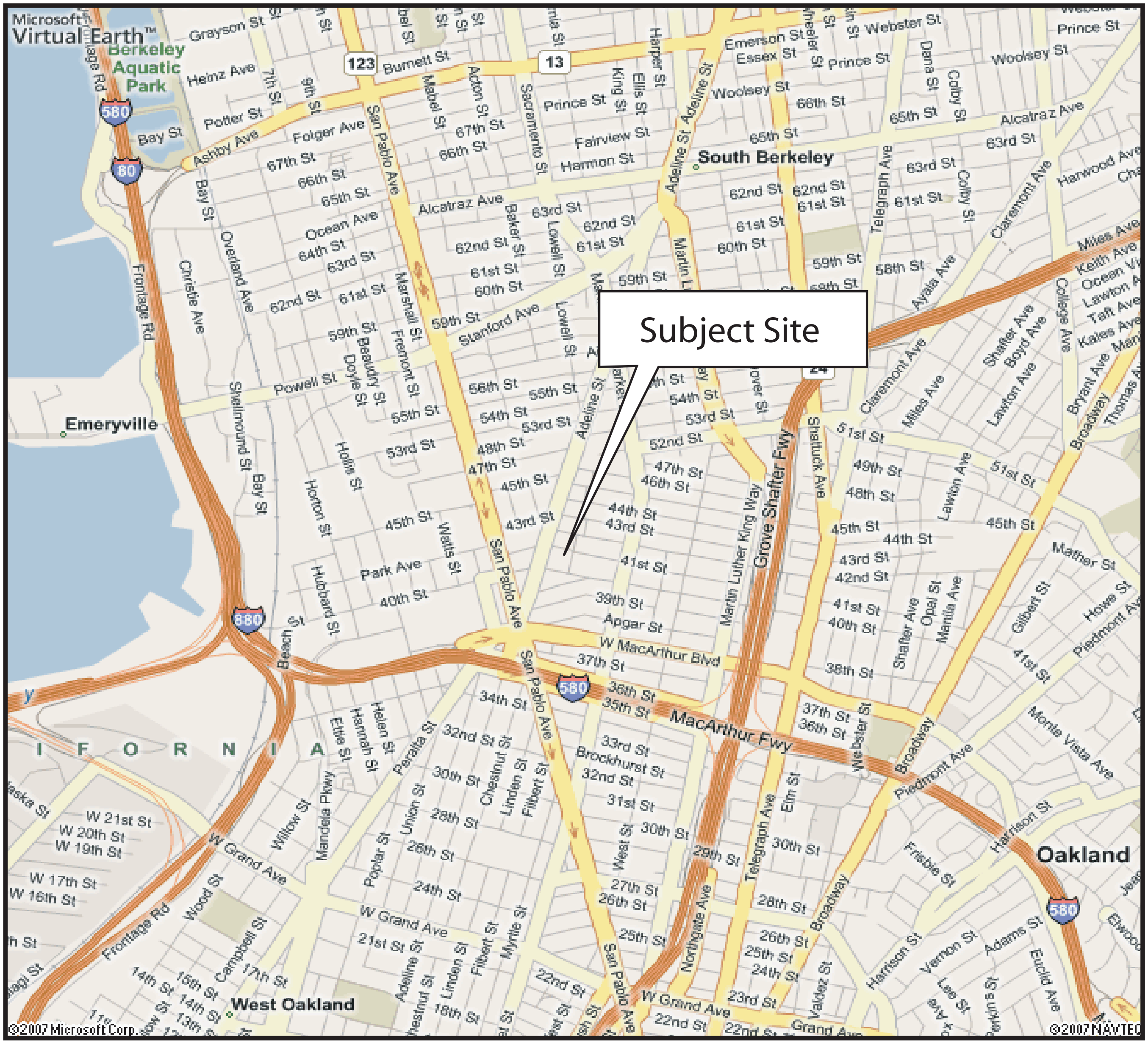
SCHUTZE & Associates, Inc.

Jan Schütze, P.G., M.Sc.
President

Attachments: Figure 1 – Location Map
Figure 2 – Site Plan
Figure 3 – Trench & Recovery Well Design

Appendix A: Work Plan Timeline
Appendix B: Remediation System Design Specifications

Figures 1 and 2
Location Map and Site Plan



Location Map
1001 - 42nd Street
Oakland, Alameda County, California

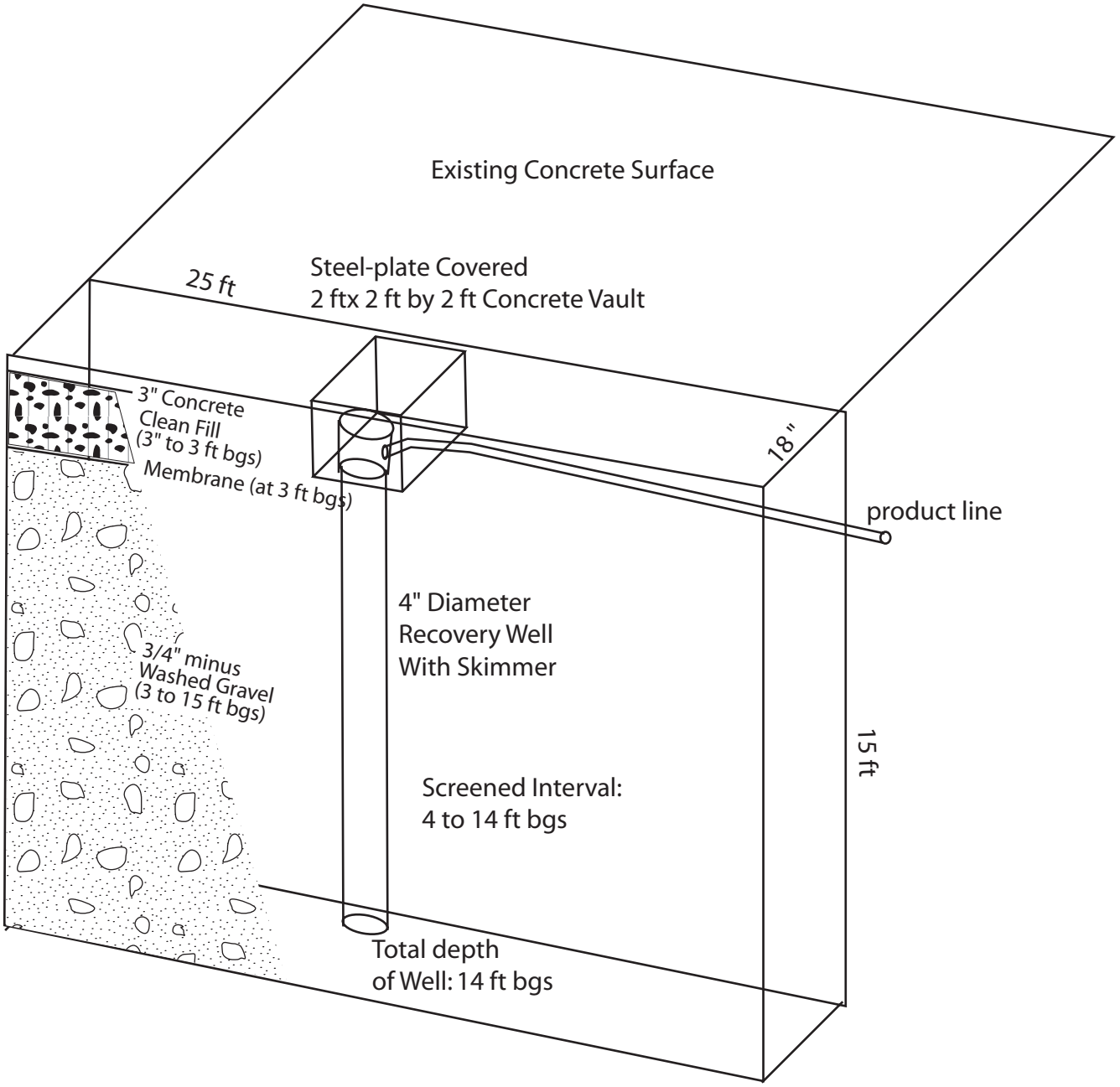
SCHUTZE & Associates, Inc.
Project Number: SCS217

FIGURE 1
January 2008

Figure 2
Proposed Remediation System
1001 42nd Street Property
Emeryville/Oakland, California

ERM 11/07

Figure 3
Trench & Recovery Well Design



Trench with Recovery Well
1001 42nd Street
Oakland, California

SCHUTZE & Associates, Inc.

March 2008

Appendix A

Work Plan Timeline

Proposed Schedule Of Completion:

The owner expects that the work shall be completed in accordance with the following time schedule:

Task #	Action	Month 1	Month 2	Month 3	Month 4	Month5	Month6
Task 1	Site Conceptual Model						
Task 2	Public Notification						
Task 3	Remediation Design and Performance Specs						
Task 4	Geotracker and ALCO-FTP Uploads						
Task 5	Repair/Replacement of MW-B1						
Task 6	Groundwater Monitoring						
Task 7	Design Specs Work Plan						
Task 8	System Construction and Start-up Support						
Task 9	Operation & Maintenance/						
	Reporting						

Appendix B

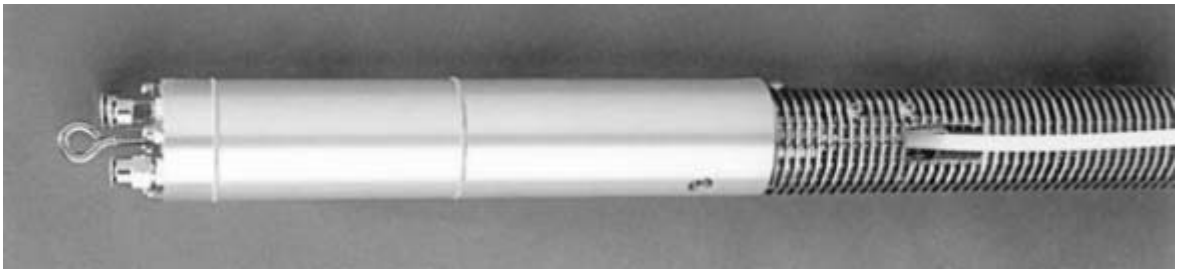
Remediation System Design Specifications

High Performance Skimmers

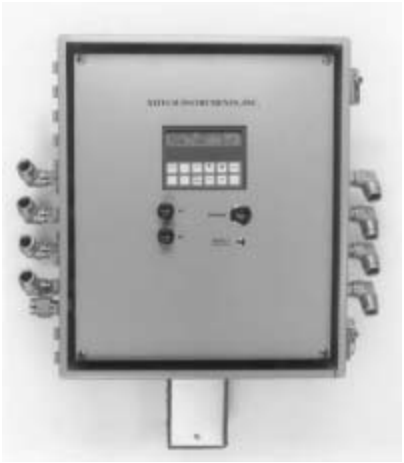
These all metal High Performance 2” Skimmers were designed to be completely chemical resistant to all LNAPLs, operate in a 212 degree steam injection environment, and fit down any 2” diameter well. These 2” Skimmers can remove light oils, as well as gasoline, diesel, #2 fuel oil, home heating oil, jet fuels JP4, JP5, and JP8, and aviation gas. Has a pumping rate up to 12 GPH, and operate to a well depth of 200 feet, and uses a dual entry hydrophobic filter. Maximum air requirements are .5 CFM @ 125 PSIG, and air quality requirements are 5-10 Microns.

Model ADJ 210
Skimmer float travel: 24 inches Size: 1.8” diameter x 51 inches long Weight: 8 pounds

Model ADJ 215 (extended travel)
Skimmer float travel: 5 feet Size: 1.8” diameter x 94 inches long Weight: 10 pounds



Timer/Controller for 8 Skimmers



The 5000 ES Programmable Controller provides individual intermittent control for 8 Skimmers through an internal solenoid assembly. Air supply is distributed from the 5000 ES out to the Skimmers in the well field. The 5000 ES provides individual logging of each Skimmer’s elapsed operating time, continuous fault monitoring of the high tank shutoff sensor, manual control over all 8 stations, battery backed program memory, and includes an electronic high tank sensor assembly.

Model 5000 ES Controller
Pumping times: 1 - 99 minutes Pumping cycles per day: 1 - 99 cycles Pumping cycles beyond a day: 1 - 99 days 8 individual control stations Programmable intermittent control Digital recording of elapsed pumping time Battery backed program memory Visual indicator displays tank full condition Power: 12 DC & 110 AC or 12 DC & 220 AC Maximum air pressure: 125 PSI Size: 12 inches x 14 inches x 6 inches NEMA 4 enclosure Weight: 31 pounds

ADJ 1000 Vacuum Enhanced Recovery
Pilot Study Procedure

The goals of this pilot study are to determine how much free product only (no water) can be recovered on a daily basis from the pilot site formation and to observe the change in the radius of influence beyond skimming only.

Objective #1: "Establish a free product recovery rate baseline and radius of influence without vacuum enhancement.

I. REQUIRED EQUIPMENT:

1. Xitech product recovery system
2. Electronic Interface meter
3. Product holding tank
4. Air supply (bottled gas or air compressor)
5. Power supply (car battery or 110AC)

II. SET UP:

1. Install the Xitech product recovery system (refer to Manual).

III. OPERATION PROCEDURE:

1. Document the amount of time it takes to remove free product to a sheen.

2. Document the amount of time it takes for the free product to return to original static level.

3. Set the pumping time in minutes and cycles per day on the electronic controller to match the documented times in steps 1 and 2. Start the skimmer recovering product. NOTE: do not interrupt the skimming operation once the test has begun.

4. Record the amount of free product recovered in each 24 hour period. Record the change in product thickness in any nearby wells.

5. Operate the skimmer for 4-5 days.

Objective #2: Quantify the changes in recovery rate and radius of influence with the application of a low vacuum applied to the well.

I. ADDITIONAL REQUIRED EQUIPMENT:

1. Vacuum source, 75-100CFM
2. Dwyer gauges in inches of water
3. Volatile Organic portable analyzer

II. SET UP:

1. Attach the vacuum source to the skimming well (refer to drawing).

2. Raise skimmer 1 foot in well without removing skimmer from well.
3. Double pumping time in minutes on the electronic timer. NOTE: DO NOT turn off the skimming operation during this set up.

III. OPERATION PROCEDURE:

1. Apply 30 inches of water vacuum to skimming well.

NOTE: You may have to install a tee and air make-up valve to reduce the vacuum force to 30 inches of water.

2. Record the amount of free product recovered for each 24 hour period. Record the vacuum force in all surrounding wells. Record the VOC concentrations coming off of the exhaust air at the vacuum source.

3. Operate the VER system for 4-5 days.

XITECH Instruments, Inc.

Well Design For Product ONLY Recovery
Application Note #3

Historically, Free Product recovery wells have been designed with Total Fluids recovery in mind. The recent implementation of the RBCA regulations (Risk Based Recovery) has given the Environmental Consultant the opportunity to focus on recovering ONLY the Free Product (LNAPL or DNAPL) on many sites. The historical problem with Free Product ONLY recovery is very low production rates, and limited range of influence. The purpose of this Application Note is to present some new ideas that may increase LNAPL production rates.

I. Change Well Annulus Material

Changing the well annulus material to medium size pea gravel would provide better conductivity between the formation and the well casing, thus increasing the LNAPL migration rate into the well. This can be accomplished because the removal rate of LNAPL out of a well is much lower than water removal, thus the migration of suspended solids into the well are greatly reduced or eliminated. Also, the sands currently being used as well annulus fill material have lower conductivity than other materials for LNAPL. This design resembles a French drain approach except we are using a vertical conduit instead of a horizontal trench.

II. Reduce The Well Boring Diameter

Reducing the well boring diameter will make it easier to develop and lowers drilling costs. LNAPL flow rates into the well are very low thus the migration of suspended solids into the well are greatly reduced or eliminated.

III. Increase Well Casing Slot Size

Typical slotted zones are usually 10 thousandths wide for holding back the #1 and #2 course sands. When medium sized pea gravel is placed in the well annulus then wider slots like 50 thousandths could be used to lower the resistance of the well screen.

IV. Use Continuous Wire Wrap Well Casing For High Viscosity Products

The typical slotted well casing material used for most Free Product recovery is Schedule 40 PVC pipe with 10 or 20 slot size. The wall thickness of the casing (1/4" wide) and the small slot height create a high surface tension barrier for the Free Product to migrate through. A better choice would be continuous wire wrap (stainless steel or PVC) with 50 thousandths slot width to lower the surface tension barrier.

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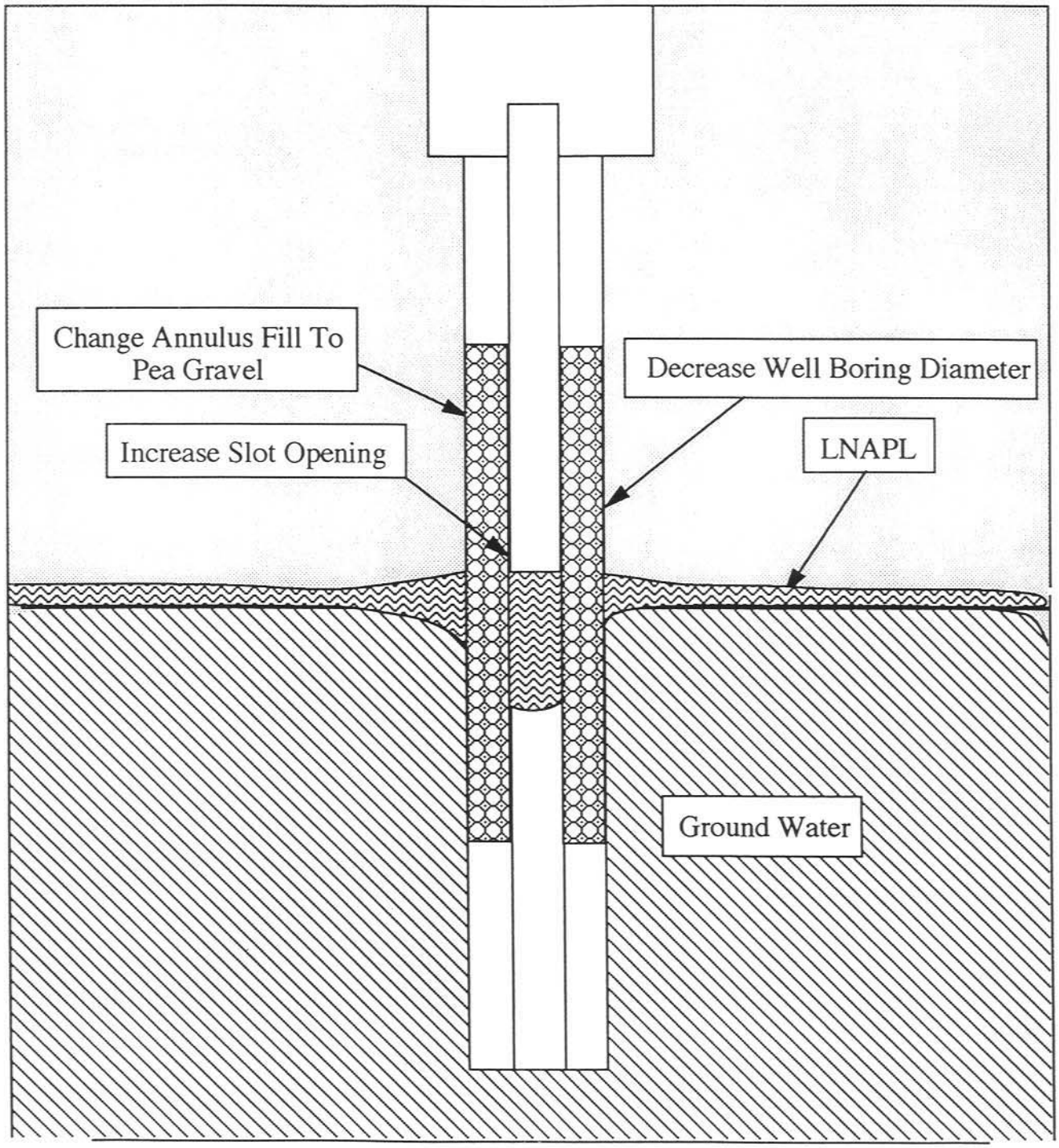
Xitech Well Design Changes



XITECH Instruments, Inc.

Free Product Well Development
Application Note #4

Historically, Free Product recovery wells have been designed with Total Fluids recovery in mind. The recent implementation of the RBCA regulations (Risk Based Corrective Action) has given the Environmental Consultant the opportunity to focus on recovering ONLY the Free Product (LNAPL) on many sites. The historical problem with Free Product ONLY recovery is very low production rates, and limited range of influence. The purpose of this Application Note is to address one of the causes and it's remedy for low production rate. If you are planning to recover ONLY Free Product (LNAPL), the location where well development is to be performed must focus on the vertical zone where the Free Product is going to enter the well.

Vacuum Assisted Well Development Of LNAPL

This method of well development is accomplished by applying a strong vacuum to the recovery well to lift the static water level up several feet in the well. While the vacuum holds the water level at an elevated height in the well place a surge block in the area just above the static water level to loosen the smeared well boring and remove the silts from the well annulus. The amount of time to develop a well can vary from 10 minutes to30 minutes depending on the soil type. This method will require a vacuum source (e.g. 50cfm @ 80 inches of water) and a special well cap for the surge block cable.

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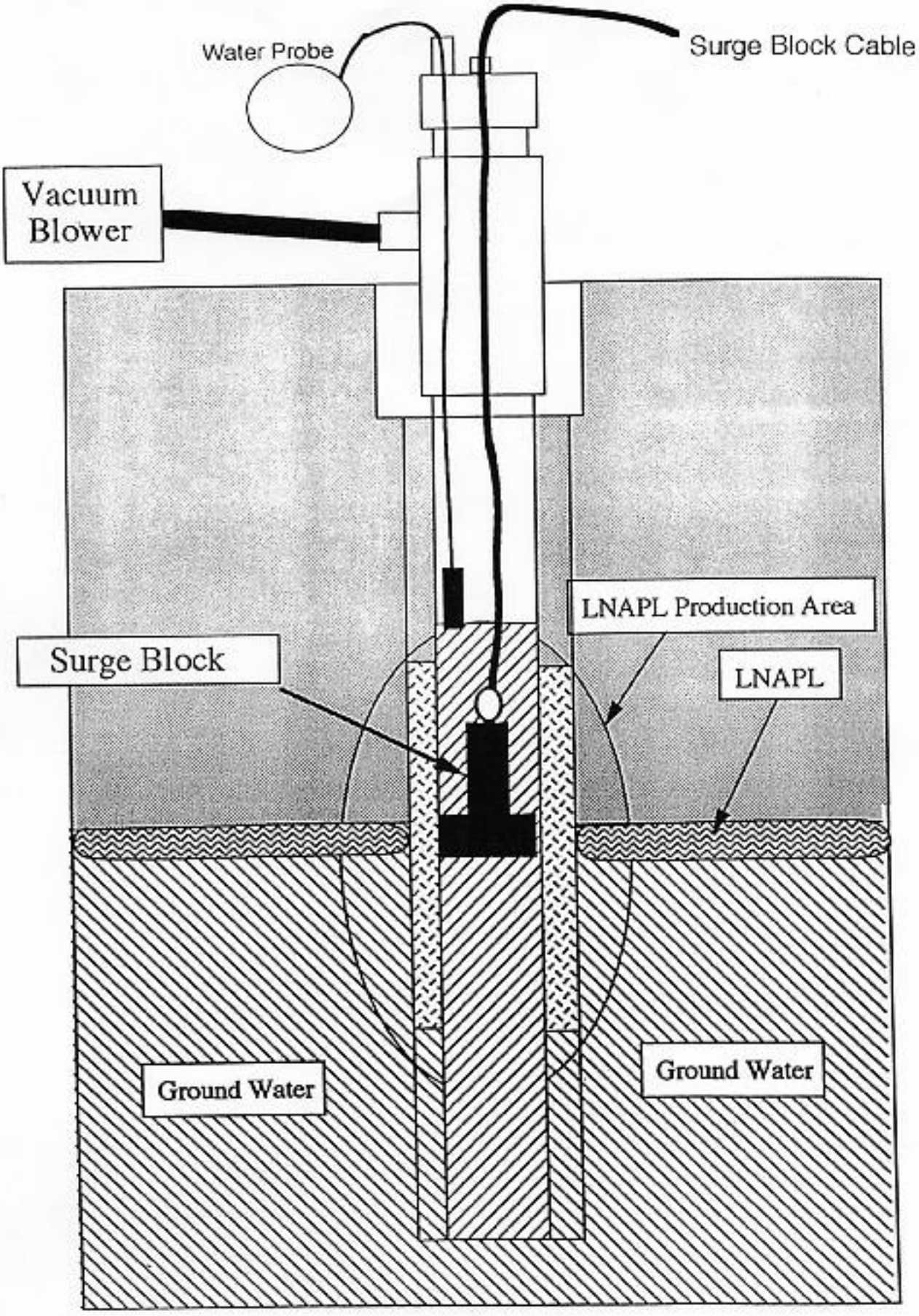
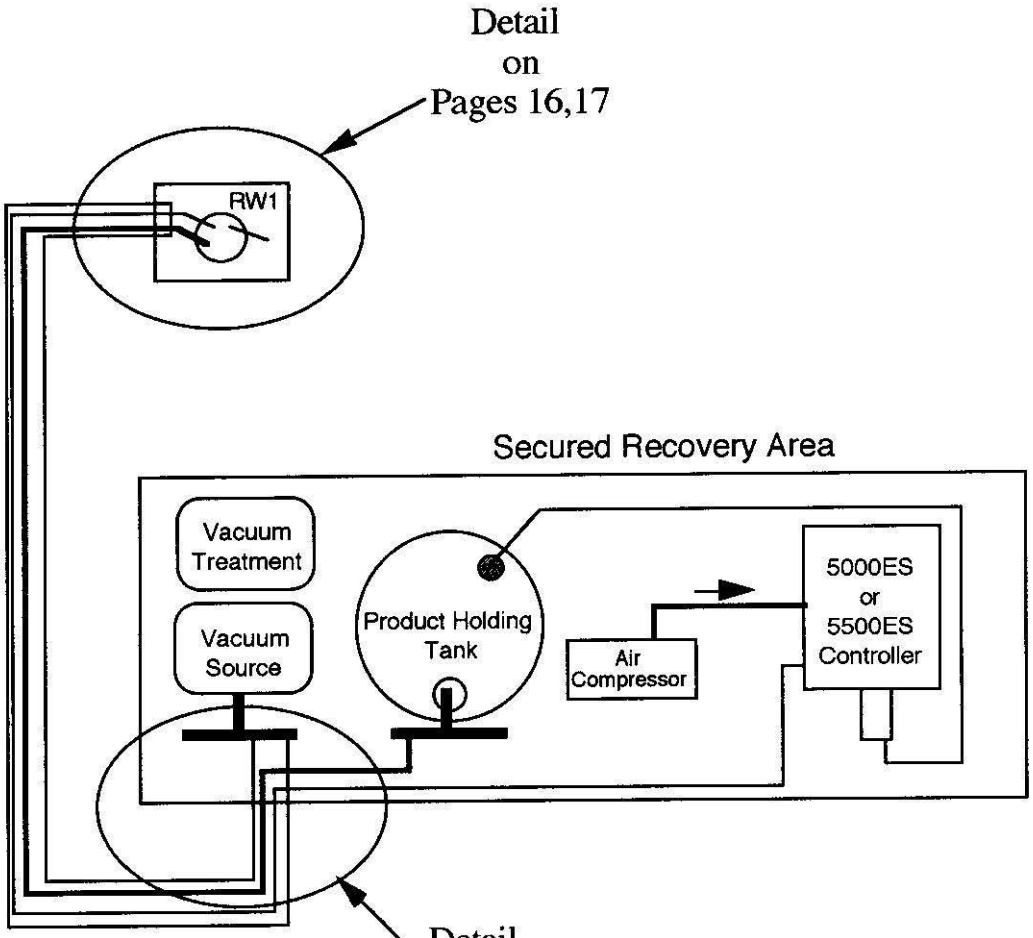
Vacuum Assisted Well Development



Multi-Well Piping
Using
Individual Air Supply and Individual Product Return
With Individual Vacuum Piping



Detail Well Design
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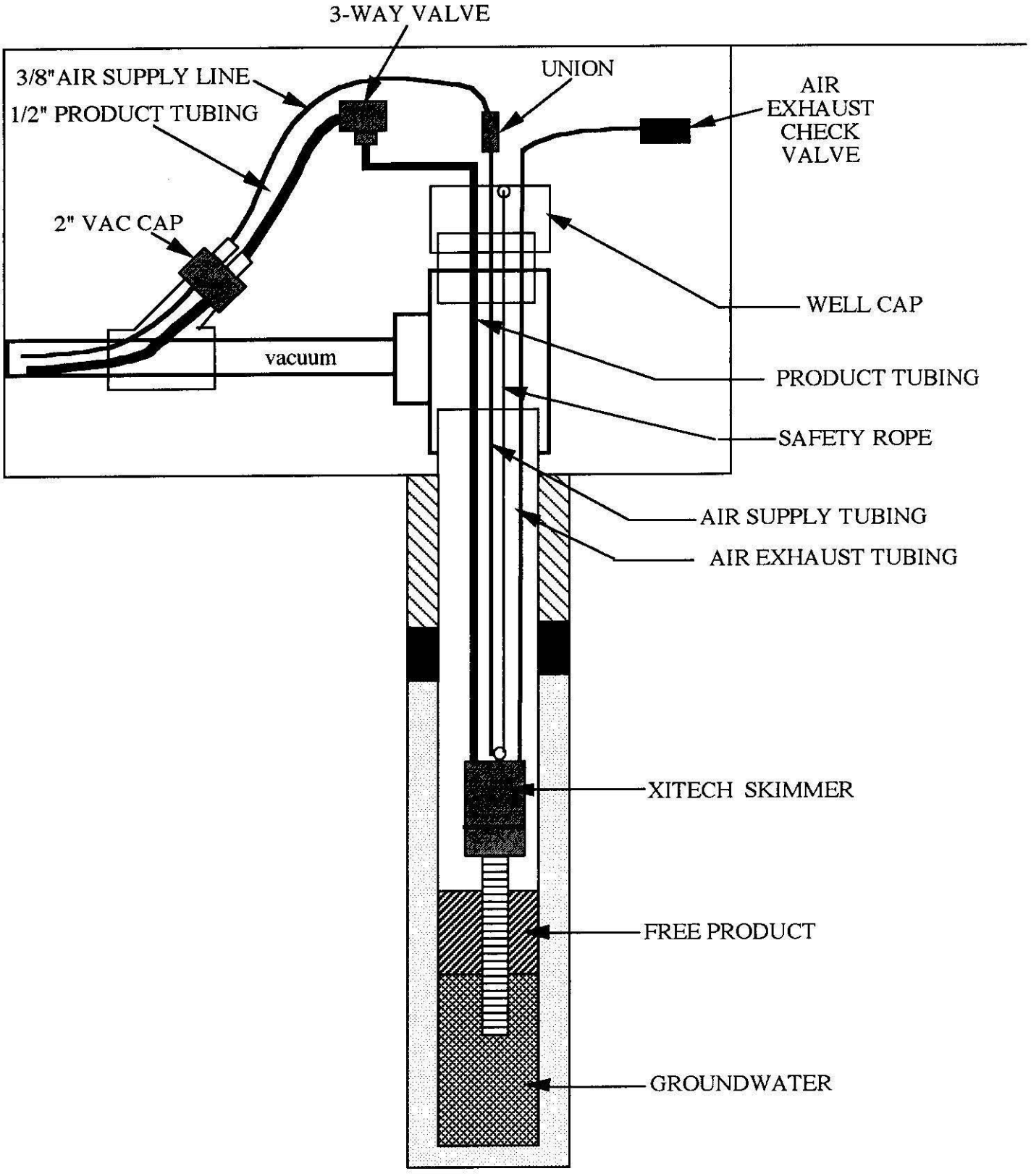

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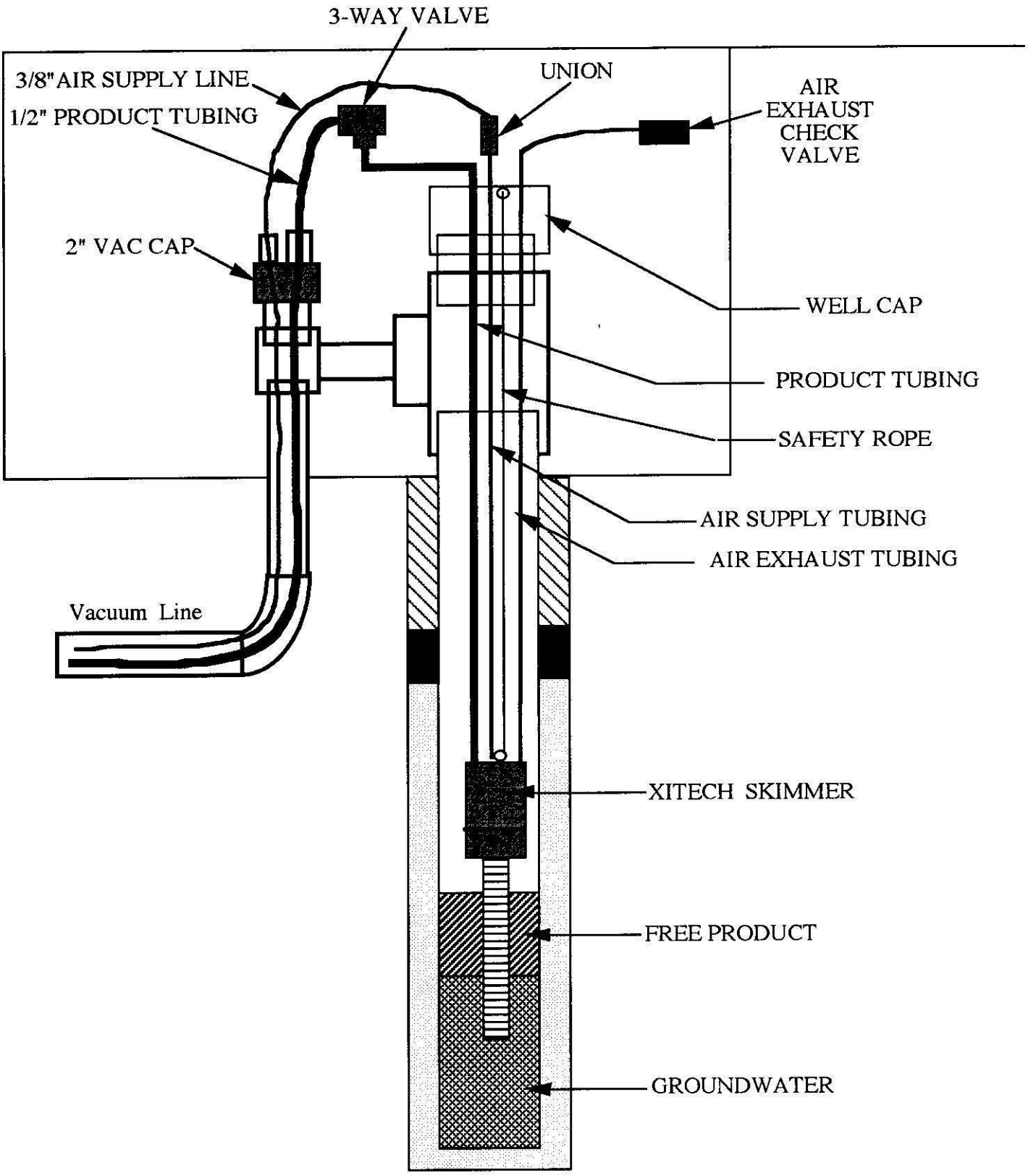

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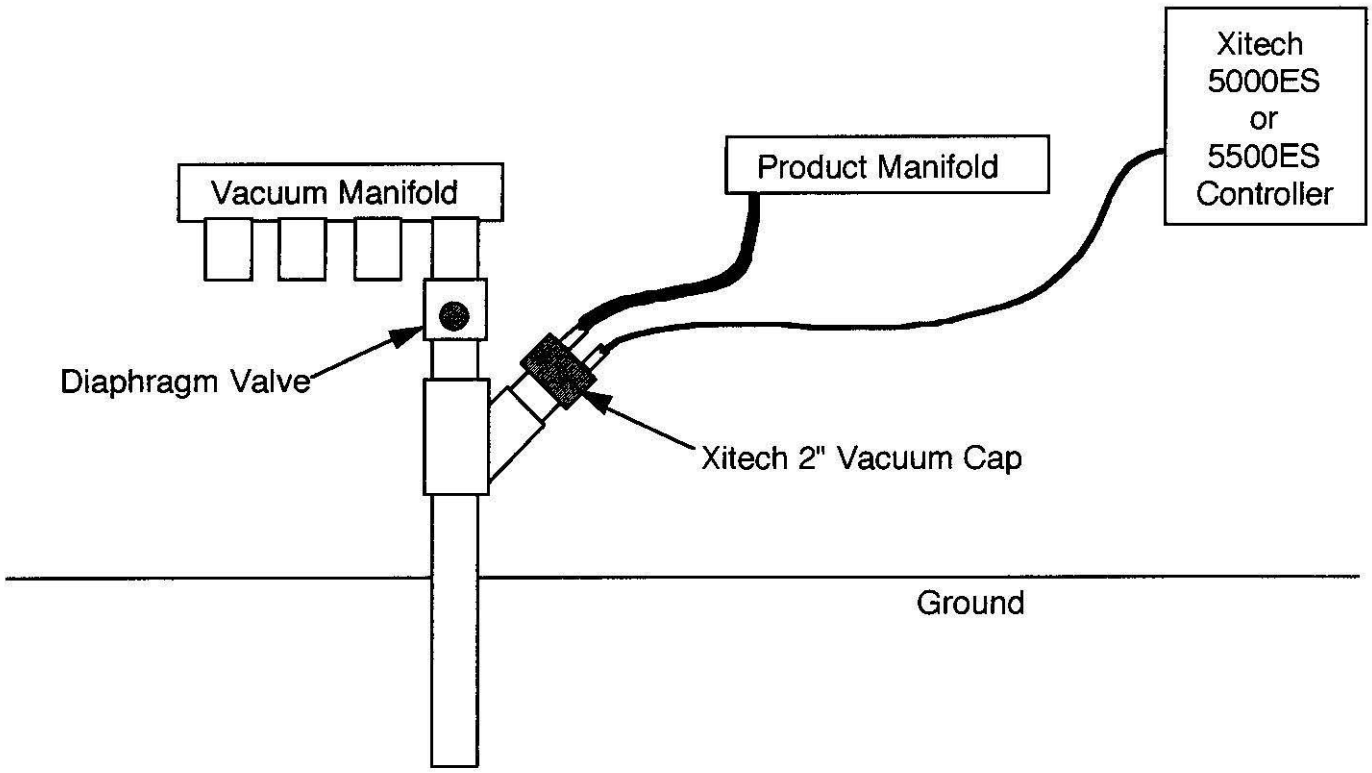

II. General Approaches to LNAPL Free Product Remediation

The Xitech Product Recovery equipment was designed for the following remediation approaches

Vacuum Enhanced Product Skimming "BIO-VEPS": This technology combination is the most aggressive approach for recovering high volumes of free product without recovering any water. Please refer to Application Notes 2,&7 for a more thorough explanation. This recovery approach is very simple. Apply a low vacuum (i.e. 10-30 inches of water vacuum) in the well to create a steady migration of LNAPL's into the well and place a skimmer pump at the water/product interface to recover the LNAPL's. This approach also provides a cost effective method for hydraulic containment of the free product and can be applied to all types of floating product.

Skimming Only Recovery: This approach of recovering free product is a low cost approach to cleaning up your site. There is also much less maintenance to this approach. However, you are trading off lower equipment costs and maintenance costs for much slower product recovery. This approach is best utilized when depths to product are between 5 and 200 feet and when free product recovery rates are less than 25 gallons per hour. Xitech Timers provide multiple choices of intermittent recovery rates, monitor the high level tank condition, and display total run time of each skimmer.

Solar Powered Skimming Only Recovery : This approach of recovery is best for remote locations; locations where isolated resources are desired or locations where resources are too costly to bring to the site. In this situation any of the ADJ Smart Skimmers can be powered by $20 bottle of air, a 2500ES controller, car battery, small solar panel. If you do not care changing bottles once a month you can use our REM2500MD remote solar powered system. This approach is best applied where steady slow free product recovery is required, when depths to product are between 5 and 100 feet, and the total column of free product removed takes more than two hours to recover.

Mobile Solar Powered Skimming Recovery : This approach of recovery is best for situations that require free product recovery of multiple wells that are remote or in locations that are restricted from using normal recovery equipment. In this situation we have designed a road certified trailer recovery system which includes one ADJ Smart Skimmer, one 2500ES timer with high level tank shutoff, one 230 gallon product tank with secondary containment, DC powered air compressor, 12 volt battery and solar panel, hose reel rigidly mounted, 150 feet of hose, and a rigid mounted housing for the skimmer.

Xitech Instruments, Inc.

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Xitech Free Product Recovery System
Technical Notes

This document addresses Xitech's remediation philosophy, design applications, and principles of operation for the Xitech Product Recovery System. Please call Xitech or any of its representatives if you have a question about this system.

I. Xitech Product Recovery Philosophy

In brief, recover as much free product that a well will give up safely in a 24 hour period.

Previous observations show that the recovery of free product without enhancements (i.e. water level drawdown or vapor extraction) can be dramatically increased if the recovery process follows the natural behavior of the product to the well. Removal of free product from a well will cause the water level to rise, and when all free product that comes into the well is removed, the water level will remain elevated above the actual free product thickness in the formation. Elevated water levels create a barrier that the free product has to overcome to re-enter the well, thus slowing down the migration of product to the well. More free product can be recovered from a well in a 24 hour period if the total volume of free product (static level) is removed periodically; That is, quickly remove the first volume of free product from the well, then let the product return to its original static level, and repeating the process, will recover significantly more free product in a 24 hour period than operating the product pump on a continuous basis. Operation costs are also reduced when free product is recovered on a periodic basis.

In addition to the importance of how quickly free product can be recovered, concern needs to be given to how safely the system is recovering this product. The three most important considerations regarding safety in recovering free product is the pumping technology, transportation from the well to a holding tank, and the control of the filling of an above ground holding tank. Xitech has selected a pneumatic pump design as the safest way of pumping an explosive fluid. Xitech's also designed a custom double containment tubing fitting for the holding tank high level sensor assembly that makes it possible to securely attach an outer protective tubing over the product discharge tubing exposed above ground.

Another safety feature Xitech has incorporated into it's recovery system is a special electronic high level sensor for the product holding tank that is tested once every second to confirm the technology is working properly. These design innovations have made the Xitech's product recovery system the preferred technology for free product remediation.

II. Xitech Product Recovery Design Applications

The Xitech Product Recovery System was designed for the following remediation applications.

Vacuum Enhanced Product Skimming "BIO-VEPS": This technology combination is the most advanced method for recovering high volumes of free product without recovering any water. Please refer to Application Note #1,2,&7 for a more thorough explanation. This recovery approach is very simple. Just apply enough vacuum in the well to create a steady migration of LNAPL's into the well and place a skimmer pump at the water/product interface to recover the LNAPL's. This method requires that the skimmer be able to recover LNAPL with up to 60 inches of water vacuum being applied to the recovery well, and pump very little water to justify the added expense of the vacuum system. All of the Xitech Smart Skimmers can satisfy these requirements. This technology also provides a cost effective method for hydraulic containment of the free product and can be applied to all types of floating product.

Intermittent LNAPL Recovery: This method of recovering free product has several advantages over traditional continuous recovery systems. The best recovery occurs when you remove all free product quickly, turn off the product pump, allow the free product to return to it's static level in the well, and then pump the free product off again. This equipment is best utilized when depths to product are between 5 and 200 feet and when free product recovery rates are less than 25 gallons per hour. Other advantages of intermittent recovery are: constant contact with the product plume, reduced air requirements, lower equipment maintenance costs and direct control over how fast the free product holding tank is filled. The Xitech Timers provide multiple choices of intermittent recovery rates, monitors the high level tank condition, and displays total run time of the pumping system.

II. Xitech Product Recovery Design Applications Cont.

Intermittent LNAPL Recovery Without AC Power: This method of recovery is best for remote locations; locations where isolated resources are desired or locations where resources are too costly to provide. In this situation any of the ADJ Smart Skimmers can be powered by $20 bottle of air, and a 2500ES or 5000ES timer powered by a 12 volt battery and solar panel. This system is best applied where steady slow free product recovery is required. The $20 bottle of compressed air will last up to thirty days in most recovery situations. This equipment is best utilized when depths to product are between 5 and 100 feet and the total column of free product removed takes more than two hours to recover.

Mobile LNAPL Recovery : This method of recovery is best for situations that require free product recovery of multiple wells that are remote or in locations that are restricted from using normal recovery equipment. In this situation we have designed a road certified trailer recovery system which includes one ADJ Smart Skimmer, one 2500ES timer with high level tank shutoff sensor, one 200 gallon product tank with secondary containment, a location for two bottles of compressed air, 12 volt battery and solar panel, hose reel rigidly mounted, 100 feet of hose, and a rigid mounted housing for the skimmer. All product discharge tubing is double contained throughout the system.

III. Xitech Product Recovery Principles Of Operation

ADJ Smart Skimmer

In the top section of the pump is an air logic valve that delivers pulses of pressurized air against the top side of a diaphragm. The air pressure causes the diaphragm to move downward which displaces product out of the pump head.

a. The air logic valve controls the pumping rate of the skimmer. By having this valve built into the pump traditional bulky above ground controls are eliminated.

b. This valve does NOT exhaust the high pressure air line, thereby saving large volumes of compressed air.

c. This valve eliminates the need to optimize the pump. The Time ON and time OFF concept has been replaced by pulses per minute.

III. Xitech Product Recovery Principles Of Operation Cont.

In the center of the pump is a fuel resistant diaphragm which pulls product into a pumping chamber when it is pushed upward by a Stainless Steel spring (located on the bottom side of the diaphragm) and pushes product out of the pump towards the surface when the air logic valve delivers a burst of air to the top side of the diaphragm.

a. This small diaphragm pumping chamber was optimized to conserve compressed air.
b. This diaphragm also prevents product from coming in contact with the compressed air source.

Below the diaphragm is a return spring which is large enough to produce a very high inlet vacuum to the skimmer. An inlet vacuum force of 10 to 12 inches of mercury enables the skimmer to retrieve very heavy fuel oils and product from wells under high vacuum extraction conditions.

Below the pump head assembly is the PRODUCT SEPARATOR ASSEMBLY which consists of a HYDROPHOBIC FILTER mounted on top of a PVC float. This assembly positions the filter half in water and half in product. The filter only allows product through its membrane and the float will follow the PRODUCT/WATER INTERFACE up to 30 inches. There is an upper plug mounted at the top the separator assembly travel to prevent water from being pumped if the skimmer is totally submerged under water.

ADJ 1000/1010 Smart Skimmer Specifications:
Hydrophobic membrane filter
Single adjustment for pumping rate built into pump head
Maximum Air consumption: .5 CFM @ 120 PSIG, 5 Micron filtering
Operating pressure range: 35-125 PSIG
Temperature range ADJ 1000: 0-75 degrees F
Temperature range ADJ 1010: 0-160 degrees F
Pumping rate: 5-25 GPH (gallons per hour)
Hydrophobic filter travel: 30 inches
Maximum operating depth is 200 feet.
Weight: 12 Lbs
Size: 3-1/2"Dia. X 48" Long
Materials ADJ 1000: PVC, Stainless Steel, Brass, Buna, Aluminum, and Viton®
Materials ADJ 1010: Stainless Steel, Brass, Buna, Aluminum, and Viton®

Actual Air Consumption of the ADJ Smart Skimmer

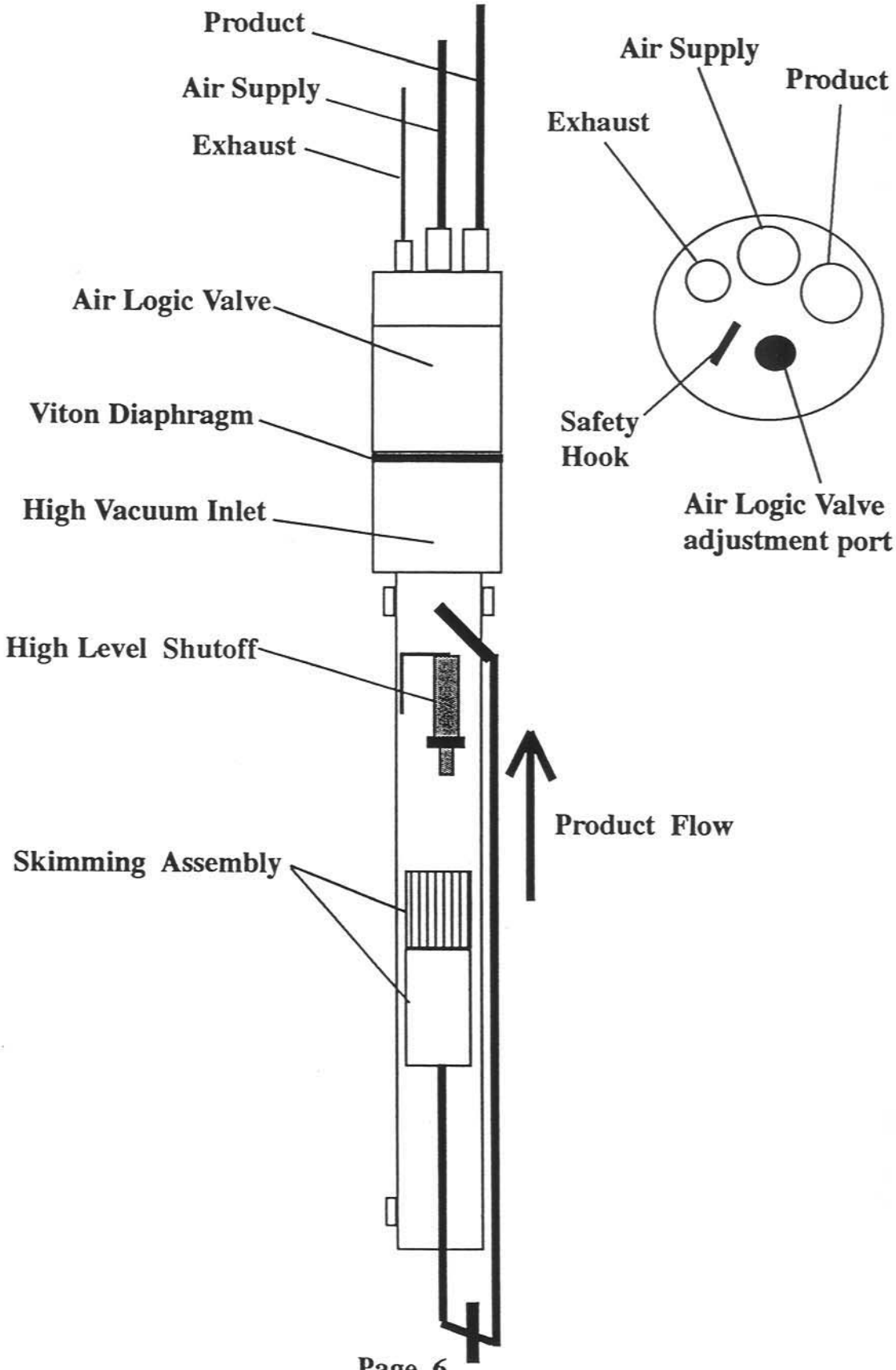
Actual air consumption data for the ADJ 1000/1010 Smart Skimmers was obtained by measuring the exhaust air with a 1% flowmeter. Different operating pressures and pumping rates were selected to cover the normal use of this technology.

Terms:
"Operating Pressure" means air pressure used to run the Skimmer.
"Pump Cycle" means the speed at which the skimmer is running.
"Air Consumption" means the rate at which the Skimmer will consume air.

Operating Pressure	**Pump Cycle Pulses/min**	**Air Consumption**
40 psi	20 pp/min	23.38 SCFH
50 psi	20 pp/min	29.44 SCFH
60 psi	20 pp/min	38.08 SCFH
70 psi	20 pp/min	39.90 SCFH
40 psi	60 pp/min	24.88 SCFH
50 psi	60 pp/min	28.30 SCFH
60 psi	60 pp/min	31.05 SCFH
70 psi	60 pp/min	32.90 SCFH
40 psi	80 pp/min	23.40 SCFH
50 psi	80 pp/min	28.15 SCFH
60 psi	80 pp/min	30.3 SCFH
70 psi	80 pp/min	34.6 SCFH

OPERATING PRESSURE CALCULATION: $\frac{35\text{psi} + \text{Total Vertical Lift}}{2.85}$

ADJ 1000 PNEUMATIC SKIMMER



III. Xitech Product Recovery Principles Of Operation Cont.

Xitech Intermittent Timers

The Xitech Timers control when the skimmer(s) get air. Operating the skimmer on an intermittent basis provides three advantages over continuous operations: intermittent skimming will recover considerably more free product in a 24 hour period; intermittent skimming provides direct site cost controls over air resources and frequency of servicing the product tank; and intermittent skimming conserves air resources to the level where bottled gas operations are feasible.

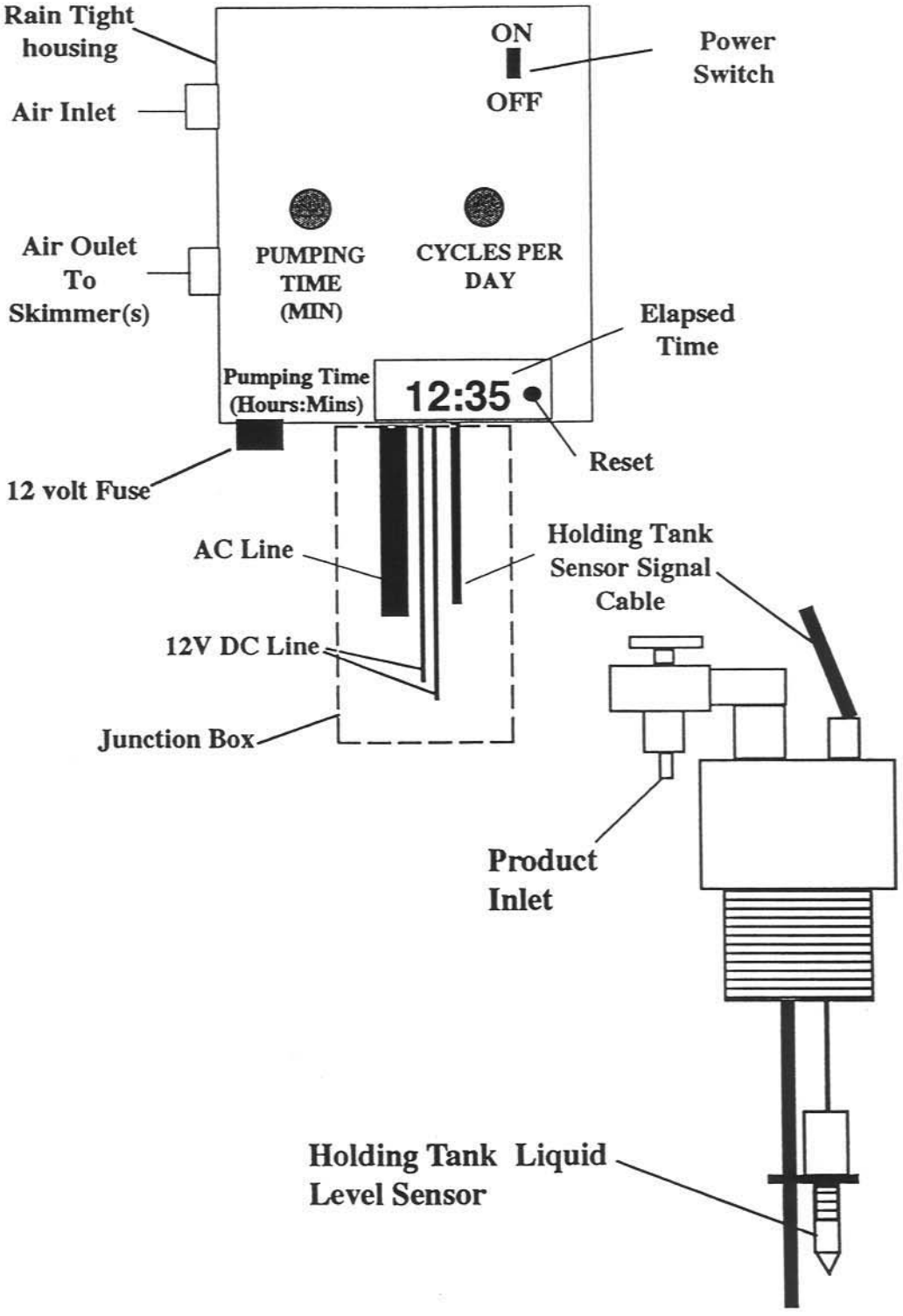
For Example: If the product in a well takes 5 minutes to pump to a sheen and 2 hours for full recovery to original static level. You would select 5 minutes for your pumping time and 12 cycles per day. Under these conditions you could operate the skimmer for up to 30 days on a single 225 cubic foot bottle of compressed gas.

The Xitech Timers will shut off the skimmer(s) when the remote high level shut-off sensor detects a full holding tank, detects an electronic failure in the shut-off sensor, or if power to the Timer is lost.

These Timers have digital hour readouts which display the total run time of the skimmer. The elapsed hour timer is only activated when the skimmer is running.

These Timers can operate on a 12VDC battery(2500ES & 5000ES only) or 110 VAC or for Europe: 12VDC or 220VAC). The Models 2500ES,5000ES, or 5500ES Timers may NOT be operated in a Class I, Division I, environment. The Model 2500ES can be converted to operate in a Class I, Division I, environment using AC or DC power. The Model 2700ES can also be operated in a Class I, Division I, environment using only compressed air as it's power source.

2500ES ELECTRONIC TIMER WITH PRODUCT HOLDING TANK HIGH LEVEL SENSOR



XITECH Instruments, Inc.

Application Note #7

Xitech, QED, And Clean Environment Comparison

In June of 1999 IT Corporation performed a technology comparison pilot study for the Navy at a site in California. The purpose of this pilot study was to observe how the top skimming technologies would perform under low vacuum conditions (BIO-VEPS conditions). It is Xitech's opinion that the pilot study procedures, operations, and data collection were carried out fairly for all skimmers. Section 4.8.2.3 clearly indicates that Xitech out performed the other two skimmers. Xitech skimmers were selected by IT Corporation to be installed on this site in June of 2000.

Type of Skimmers tested:
Xitech Skimmer: ADJ1000
Clean Environment Skimmer: GENIE+SPG-4 Standard
QED Skimmer: HIGH CAPACITY FERRET, Model HIWSFI12

Report Omissions:
The Xitech Skimmer operated on 1 bottle of compressed gas for the entire test period, while both the GENIE and the FERRET required an air compressor.

Xitech Conclusions:
I do not agree with the emphasis stated in 4.8.2.4 that maintenance requirement is the most important factor. The cost of hauling off water as hazardous material has been our customers' biggest concern. The FERRET recovered 66% water, the GENIE recovered 45% water, and the ADJ1000 recovered only 3.8% water. It seemed from the Report Summary that water was really an issue.

Another major concern our customers have is minimum product layer achievable by skimmers. The GENNIE's minimum product layer was 1 inch where as both the ADJ1000 and the FERRET minimum product layer was a sheen.

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4.8.2.2 Extraction Well Yield

The product yields of each well during each week of the pilot test (Table 4-3) were similar (i.e. for each skimmer pump). The average daily recovery rates were 3.22, 1.40, and 7.33 gpd from extractions wells EW-2, JMM01-MW06, and JMM01-MW05, respectively. The average recovery rate for one well (from the 3 test wells) was 4 gpd. The cumulative product volumes recovered are presented graphically in Appendix E, and indicate that the yield of each well was constant during the test. However, the yield is expected to decrease over time during a long-term operation.

4.8.2.3 Skimmer Recovery Rates

The extraction rates and total volumes of each pump are summarized in Table 4-3. The total volumes of product and water extracted using the QED pump were 66.5 and 130.5 gallons, respectively. A total of 53.5 gallons of product and 44.0 gallons of water was extracted with the CEE pump, and 67.5 gallons of product and 2.7 gallons of water with the Xitech pump. However, the product recovery volumes can not be directly compared because the CEE pump only operated for three of the five days at well JMM01-MW05, the most productive well.

Water recovery to product recovery ratios for the skimmers were calculated at 2.6 for the QED skimmer, 1.5 for the CEE skimmer, and 0.0 for the Xitech skimmer.

The pumping rates of all 3 skimmers are higher than the yield of Site 1 wells; therefore, each of the skimmers has sufficient capacity.

4.8.2.4 Skimmer Comparison

The performance of the three skimmers was compared using the following criteria: operation and efficiency, maintenance and troubleshooting, technical advantages and disadvantages. The test included a change of an extraction well during the first week and troubleshooting of the skimmers during most of the first two weeks. The last week of operation shows each skimmer at its best performance and was used to evaluate the overall performance. The emphasize was put on the maintenance requirement as the most important factor for long-term operation. The skimmer parts and accessories are presented in Appendix E. The comparison is summarized in Table 4-4.

Operation and Efficiency

The CEE skimmer - The skimmer is assembled at the bottom of the bladder pump, and the controller is mounted on top of the pump for in-well control. This assembly leaves no part above